

**INCOHERENT LIGHT-EMITTING DEVICE APPARATUS**  
**FOR DRIVING VERTICAL LASER CAVITY**

**CROSS REFERENCE TO RELATED APPLICATION**

This is a continuation-in-part of commonly assigned U.S. Patent  
5 Application Serial No. 09/832,759, filed April 11, 2001, <sup>Pat. 6,658,037</sup> entitled "Incoherent  
Light-Emitting Device Apparatus for Driving Vertical Laser Cavity" by Keith B.  
Kahen et al.

**FIELD OF THE INVENTION**

The present invention relates to the field of light-emitting devices,  
10 in particular, to organic-based solid-state lasers.

**BACKGROUND OF THE INVENTION**

Over the past number of years, there has been increasing interest in  
making organic-based solid-state lasers. The lasing material has been either  
15 polymeric or small molecule and a number of different resonant cavity structures  
were employed, such as, microcavity (Kozlov et al., U.S. Patent 6,160,828),  
waveguide, ring microlasers, and distributed feedback (see also, for instance,  
G. Kranzelbinder et al., Rep. Prog. Phys. 63, 729 (2000) and M. Diaz-Garcia et  
al., U.S. Patent No. 5,881,083). A problem with all of these structures is that in  
20 order to achieve lasing it was necessary to excite the cavities by optical pumping  
using another laser source. It is much preferred to electrically pump the laser  
cavities since this generally results in more compact and easier to modulate  
structures.

A main barrier to achieving electrically-pumped organic lasers is  
25 the small carrier mobility of organic material, which is typically on the order of  
 $10^{-5} \text{ cm}^2/(\text{V}\cdot\text{s})$ . This low carrier mobility results in a number of problems.  
Devices with low carrier mobilities are typically restricted to using thin layers in  
order to avoid large voltage drops and ohmic heating. These thin layers result in  
the lasing mode penetrating into the lossy cathode and anode, which causes a large  
30 increase in the lasing threshold (V.G. Kozlov et al., J. Appl. Phys. 84, 4096  
(1998)). Since electron-hole recombination in organic materials is governed by